

MASSACHUSETTS WATER RESOURCES COMMISSION
Hydrologic Conditions in Massachusetts
September 2016 Summary



- September precipitation ranged from normal to below normal.
 - September streamflows were below normal and have been for 5 to 7 months.
 - September groundwater levels were below normal and have been for 1 to 7 months.
 - September reservoir levels were normal for 3 regions and below normal for 3 regions.

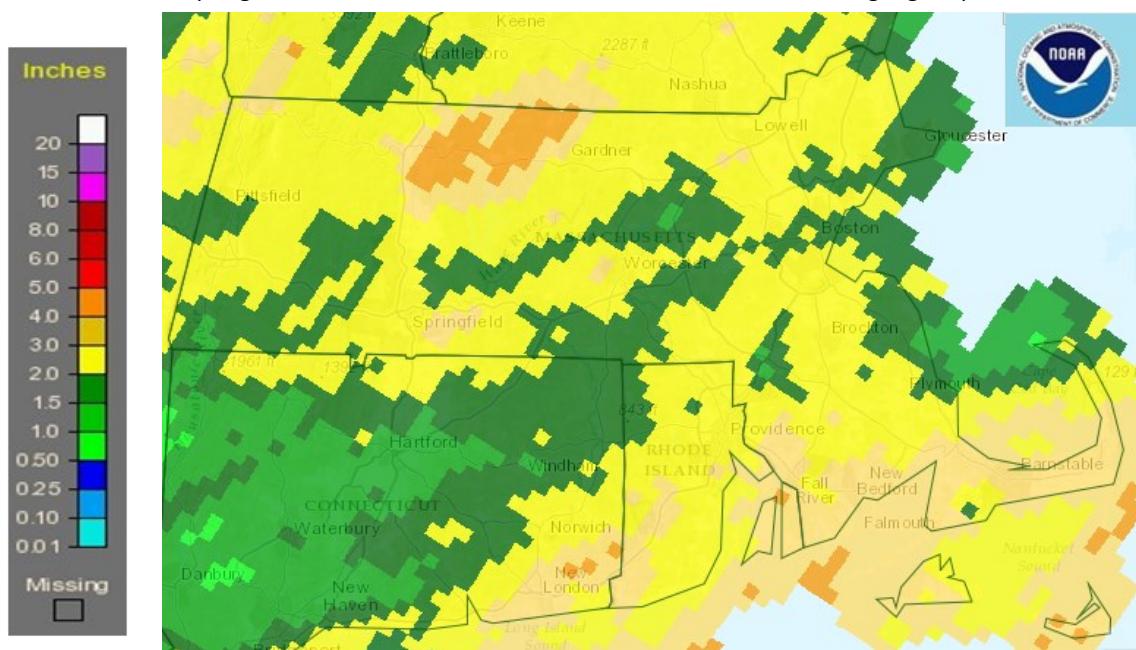
PRECIPITATION CONDITIONS

Region	SEPTEMBER Estimated Rainfall: Composite Sites Reporting (inches)	Departure from Normal (inches)	MA Drought Management Plan Levels	
			Standardized Precipitation Index (SPI)	Percent of Normal Index
Cape Cod & Islands	3.00	-0.81	Advisory	Watch
Central	2.67	-1.13	Watch	Watch
Connecticut River	2.92	-1.02	Watch	Watch
Northeast	1.77	-1.71	Warning	Emergency
Southeast	1.9	-1.84	Watch	Warning
Western	2.69	-1.39	Normal	Normal

September 2016 Observed Precipitation

Map from the National Weather Service (NWS) Advanced Hydrologic Prediction Center (<http://water.weather.gov/precip/>)

The map is generated based on radar data correlated to NWS rainfall gauge reports



STREAMFLOW CONDITIONS

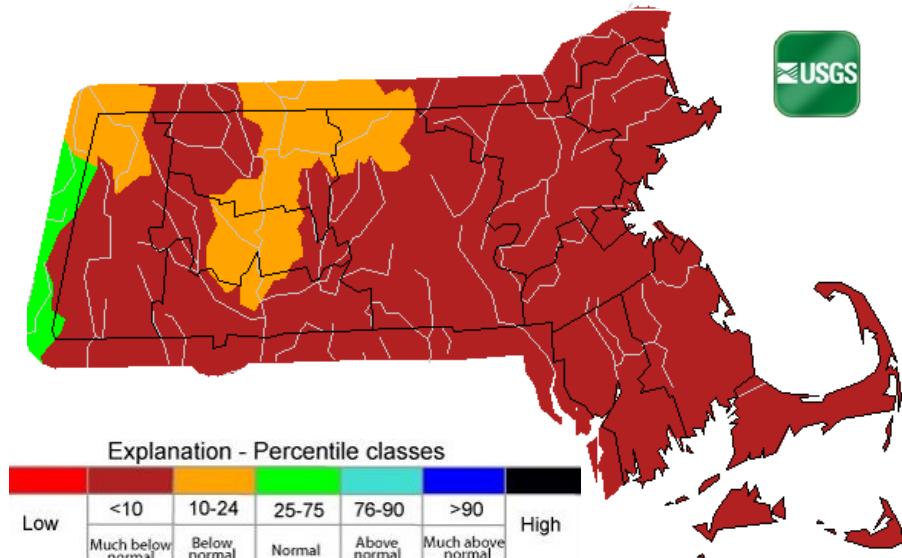
General Streamflow Conditions in Massachusetts September 2016

Region	Number of stream gages	MA Drought Plan Index (# months majority below 25 th percentile)	Number of gages below 10 th percentile for Sept	Number of gages at Record Low for Sept
Central	16	Warning (7 months)	8	3
Connecticut River	16	Warning (6 of 7 months)	12	3
Northeast	19	Warning (7 months)	13	6
Southeast	5	Warning (6 of 7 months)	4	2
Western	7	Watch (5 of 7 months)	4	1

Note: Streamflow conditions for individual streamflow-gaging stations may differ from general conditions.
Streamflow index is not applied to Cape Cod and the Islands

Monthly Streamflow Compared to Historical Streamflow for the Month of the Year

Streamflow is monitored by the Commonwealth of Massachusetts and United States Geological Survey (USGS) cooperative stream gaging program.
Updated maps may be found at <http://waterwatch.usgs.gov/index.php?r=ma&id=mv01d>



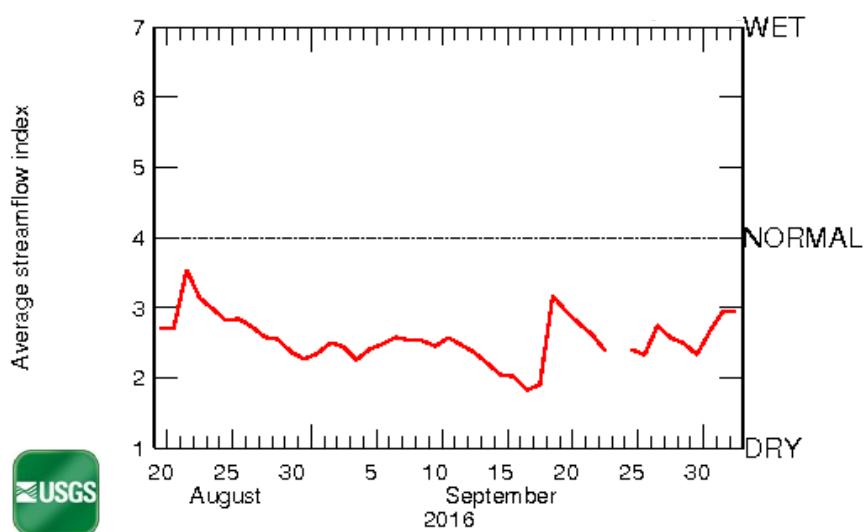
Daily Streamflow Compared to Historical Streamflow for the Day of the Year

This plot depicts data for the 45-day period ending October 3.

Updated plots may be found at:
http://waterwatch.usgs.gov/index.php?id=real&sid=w__plot&r=ma

KEY:

- 1 = New record low for day
- 2 = < 10th percentile
- 3 = 10th – 24th percentile
- 4 = 25th – 74th percentile
- 5 = 75th – 89th percentile
- 6 = > 90th percentile
- 7 = New record high for day

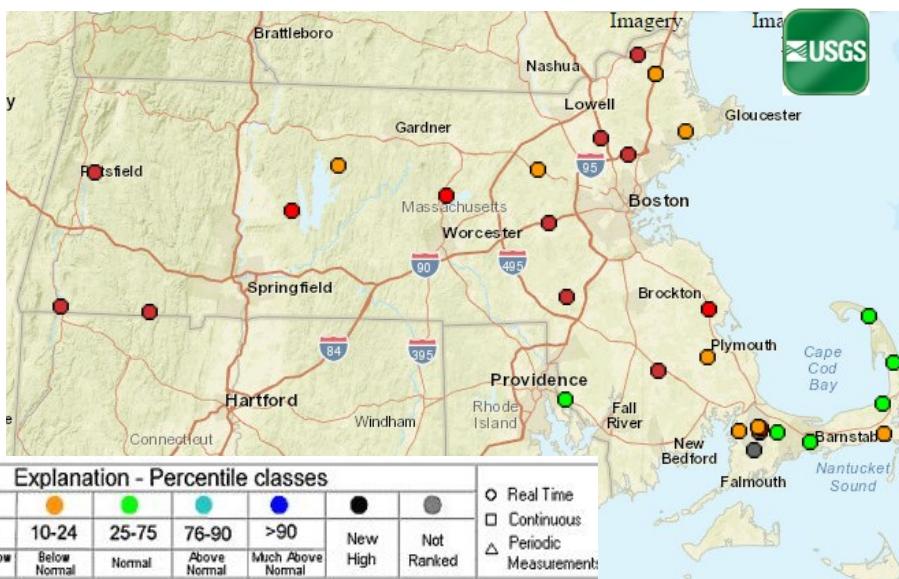


GROUNDWATER LEVELS

Region	Number of groundwater wells	MA Drought Plan Index (# consecutive months majority below 25 th percentile)	Number of wells below 10 th percentile for Sept	Number of wells at Record Low for Sept
Cape & Islands	13	1	1	0
Central	10	6	2	0
CT River	11	6	7	5
Northeast	17	6	14	5
Southeast	12	5	10	3
Western	5	7	4	1

Note: Groundwater conditions for individual wells may differ from general conditions.

Real-Time Groundwater Conditions on October 4, 2016 from USGS <http://groundwaterwatch.usgs.gov/NetMapT1L2.asp?ncd=rtn&sc=25>



RESERVOIR LEVELS

General Reservoir Levels in Massachusetts at the end of September 2016		
Region	Reservoir Levels	MA Drought Management Plan Reservoir Index
Cape Cod & Islands	Normal	Normal
Central	Below*	Watch
Connecticut River	Normal	Normal
Northeast	Below*	Watch
Southeast	Below	Watch
Western	Normal	Normal

*At least one reservoir at 2 standard deviations below.

NWS/NOAA DROUGHT OUTLOOK AND FORECAST

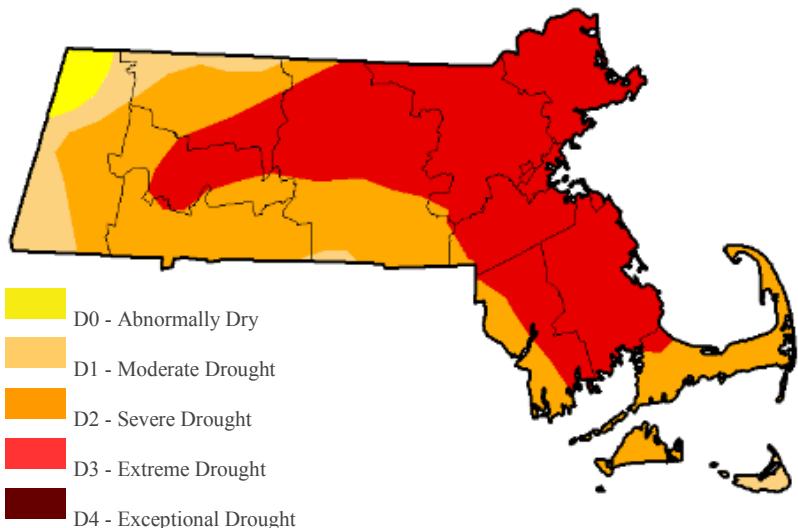
U.S. Drought Monitor: Massachusetts, September 27, 2016

Summary: As of September 27, 2016, the U.S. Drought Monitor shows that 90 percent of Massachusetts is either in an extreme or severe drought.

Produced by the National Drought Mitigation Center (NDMC). Intensity based on NDMC criteria.

For updated map see:

<http://droughtmonitor.unl.edu/Home/StateDroughtMonitor.aspx?MA>



U.S. Seasonal Drought Outlook: Drought Tendency During September 15 - December 31

The Outlook projects drought persistence and/or intensification in Massachusetts.

http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php



NOAA National Weather Service Climate Prediction Center

The Climate Prediction Center 6-10 day Outlook for October 9 to 13 indicates a 40-50 percent probability for below normal temperatures and 40-50 percent probability for above normal precipitation for Massachusetts (<http://www.cpc.noaa.gov/products/predictions/610day/>).

The Center's three-month outlook (October through December) shows above normal temperatures and normal signal for precipitation anomaly (http://www.cpc.noaa.gov/products/predictions/long_range/seasonal.php?lead=1). More information is available at (<http://www.cpc.noaa.gov/index.php>).

Key Links: Massachusetts Drought Management: <http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/drought-status.html>

DCR Precipitation Monitoring Composite Reports and SPI

<http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/rainfall-program.html>

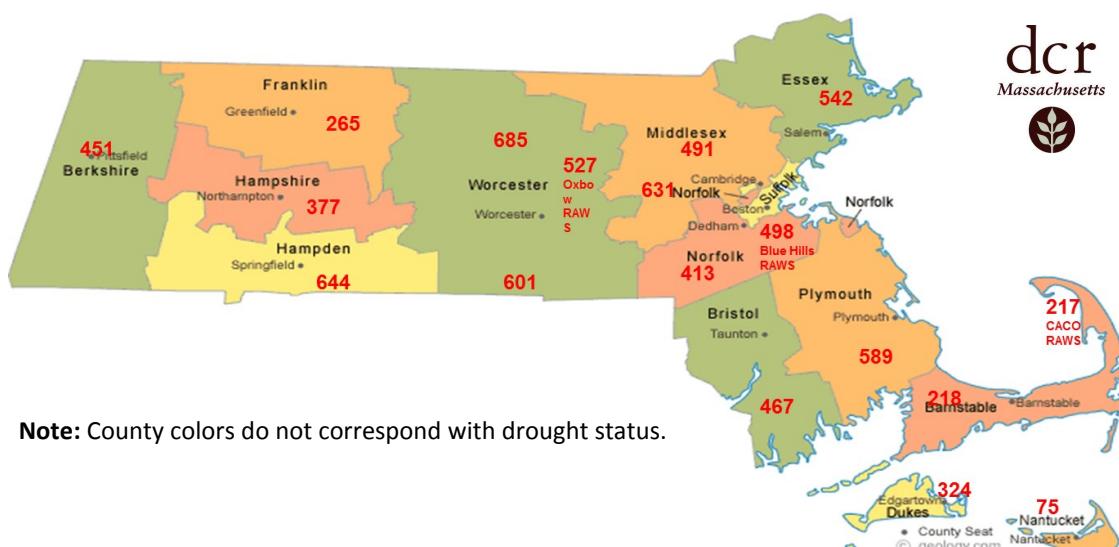
October 4, 2016: This report was prepared by the Massachusetts Department of Conservation and Recreation. Data may be preliminary in nature. Additional information, previous hydrological conditions reports, and drought management information can be found on our web site: <http://www.mass.gov/eea/agencies/dcr/water-res-protection/water-data-tracking/>

Appendix I: Additional Information

Keetch-Byram Drought Index by DCR Forest Fire Control Districts as of October 3, 2016

Region	MA Drought Plan Index
Cape Cod & Islands*	Advisory
Central	Warning
Connecticut River	Watch
Northeast	Watch
Southeast	Watch
Western	Watch

Note: *Nantucket is normal



Crop Moisture Index for the Week Ending September 24, 2016

The Crop Moisture Index shows the short-term need versus available water in a shallow soil profile.
(Up-to-date maps: http://www.cpc.noaa.gov/products/analysis_monitoring/regional_monitoring/cmi.gif)

Region	September Index
Cape & Islands	Advisory
Central	Normal
CT Valley	Normal
Northeast	Advisory
Southeast	Advisory
West	Normal



- | | | | |
|---|---|---|---------------------------------|
| ■ | -3.0 or less (Severely Dry) | ■ | +1.0 to +1.9 (Abnormally Moist) |
| ■ | -2.0 to -2.9 (Excessively Dry) | ■ | +2.0 to +3.0 (Wet) |
| ■ | -1.0 to -1.9 (Abnormally Dry) | ■ | 3.0 and above (Excessively Wet) |
| ■ | -0.9 to +0.9 (Slightly Dry/Favorably Moist) | | |

Appendix II: Description of Drought Indices

(from Table 3 of Massachusetts Drought Management Plan).

Drought Level	Standardized Precipitation Index	Crop Moisture Index*	Keetch-Byram Drought Index*	Precipitation	Groundwater	Streamflow	Reservoir**
Normal	3-month > -1.5 or 6-month > -1.0 or 12-month > -1.0	0.0 to -1.0 slightly dry	< 200	1 month below normal	2 consecutive months below normal**	1 month below normal**	Reservoir levels at or near normal for the time of year
	3-month = -1.5 to -2.0 or 6-month = -1.0 to -1.5 or 12-month = -1.0 to -1.5	-1.0 to -1.9 abnormally dry	200-400	2 month cumulative below 65% of normal	3 consecutive months below normal**	At least 2 out of 3 consecutive months below normal**	Small index Reservoirs below normal
	3-month < -2.0 or 6-month = -1.5 to -3.0 or 12-month = -1.5 to -2.0	-2.0 to -2.9 excessively dry	400-600	1 of the following criteria met: 3 month cum. < 65% or 6 month cum. < 70% or 12 month cum. < 70%	4-5 consecutive months below normal**	At least 4 out of 5 consecutive months below normal**	Medium index Reservoirs below normal
Watch	6-month < -3.0 or 12-month = -2.0 to -2.5	< -2.9 severely dry	600-800	1 of the following criteria met: 3 month cum. < 65% and 6 month cum. < 65%, or 6 month cum. < 65% and 12 month cum. < 65%, or 3 month cum. < 65% and 12 month cum. < 65%	6-7 consecutive months below normal**	At least 6 out of 7 consecutive months below normal**	Large index reservoirs below normal
	12-month < -2.5	<-2.9 severely dry	600-800	Same criteria as Warning and previous month was Warning or Emergency	>8 months below normal**	>7 months below normal**	Continuation of previous month's conditions
	Emergency						

* The Crop Moisture Index is subject to frequent change. The drought level for this indicator is determined based on the repeated or extended occurrence at a given level.

** Below normal for groundwater and streamflow are defined as being within the lowest 25th percentile of the period of record.
*** Water suppliers should be consulted to determine if below normal reservoir conditions are due to operational issues.